

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Applicant: Kari Sundman et al. : Confirmation No.: 3051
Application No.: 10/519,350 : Art Group: 1731
Filing Date: July 14, 2006 : Examiner: Jose A. Fortuna
For: METHOD FOR TREATMENT OF SPENT LIQUOR

APPEAL BRIEF (37 C.F.R. §41.37)

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P.O. Box 1450
Alexandria, VA 22313-1450

May 27, 2008

SIR:

This Brief is in furtherance of the Notice of Appeal, filed in this case on March 26, 2008.

REAL PARTY IN INTEREST (37 C.F.R. §41.37(c)(1)(i))

The real party of interest are METSO POWER OY, formerly known as KVAERNER POWER OY, the assignee of interest.

I. RELATED APPEALS AND INTERFERENCES (37 C.F.R. §41.37(c)(1)(ii))

NONE

II. STATUS OF CLAIMS (37 C.F.R. §41.37(c)(1)(iii))

Claims 1-5 and 7-10 are on appeal and stand REJECTED.

III. STATUS OF AMENDMENTS FILED SUBSEQUENT TO FINAL REJECTION (37 C.F.R. §41.37(c)(1)(iv))

An amendment filed on February 26, 2008, in response to the final Office Action dated December 27, 2007, was not entered. In an Advisory Action dated March 18, 2008, the Examiner maintained that the newly added limitation regarding the evaporable water needs further consideration and/or search.

IV. SUMMARY OF CLAIMED SUBJECT MATTER (37 C.F.R. §41.37(c)(1)(v))

Method for treatment of black liquor at a pulp mill in order to recover its contents of chemicals and energy, comprising the following steps

passing a black liquor flow (10) from an evaporation plant to a pyrolysis reactor (1); {Pub. App. paragraphs 0018-0021; Figs. 1-4}

pyrolysing the black liquor in the pyrolysis reactor at a temperature of 300-800°C in the absence of an external gas component in order to separate evaporable compounds (12) from coke (11) remaining in a solid state, {Pub. App. paragraphs 0018, 0024}

recovering the evaporable compounds (12) from the pyrolysis reactor, {Pub. App. paragraph 0034; Figs. 1-4}

passing the coke (11) from the pyrolysis reactor to a gasification reactor (3) for gasification, {Pub. App. paragraph 0035; Figs. 1-4}

gasifying the coke in the gasification reactor under such conditions that sulphur compounds contained in the coke (11) and deriving from the cooking chemicals are reduced to sodium sulphide; and {Pub. App. paragraphs 0038-0042; Figs 1-4}

recovering produce gases generated by gasification in the gasification reactor.
{Pub. App. paragraphs 0041-0042; Figs. 1-4}

V. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL (37 C.F.R. §41.37(c)(1)(vi))

Whether Claims 1-5 and 7-10 are patentable under 35 U.S.C. §103(a) over Brink, U.S. Patent No. 3,639,111 ("Brink") in view of Hess, U.S. Patent No. 3,607,619 ("Hess").

VI. ARGUMENT (37 C.F.R. §41.37(c)(1)(vii))

Independent Claim 1, as well as dependent Claims 2-5 and 7-10, stand rejected by the Examiner as unpatentable under 35 U.S.C. §103(a) over Brink in view of Hess. Applicants respectfully traverse the rejection.

The Examiner cites Brink as disclosing a method for treatment of spent black liquor in order to recover its contents of chemicals and energy, wherein a spent liquor flow arriving from the evaporation plant is taken to a pyrolysis reactor, wherein it is pyrolysed at a temperature of about 400° to 750°C, which contains two specific points within the claimed range of 300° to 800°C, and the coke is taken to a gasification reactor for gasification, which gasification is implemented under such conditions that the sulphur compounds contained in the coke and deriving from the cooking chemicals are reduced to sodium sulphide. The Examiner noted that Brink does not disclose expressly that evaporable compounds are recovered before gasification. The Examiner cites Hess as

purportedly disclosing recovering gases produced by pyrolysis. As will be shown, Brink and Hess fail to disclose a number of elements of Claims 1-5 and 7-10.

Recovery of Dimethyl Sulfide

Applicants note that there is no reason that would have prompted a person of ordinary skill in the art to combine the elements of Brink and Hess in the way the present invention does. Recovery of dimethyl sulfide would not be a plausible reason because the process of Brink is specifically aimed at avoiding the formation of dimethyl sulfide. Dimethyl sulfide is an irritant liquid or gas that has an unpleasant odor at even low concentrations. The purpose of the Hess process is not to produce dimethyl sulfide; rather the compound is formed as an undesired byproduct in the wet-coking process. Hess proposes recovering dimethyl sulfide only because it would not be advisable to discharge the gas into the atmosphere.

Furthermore, dimethyl sulfide is not an intended product of the Brink process. The object of Brink is to provide a simple method and apparatus for pyrolyzing and destructively distilling organic material, which will prevent formation of atmospheric pollutants. Brink intends to form a clean fuel that can be burned to provide energy which is applicable to the treatment of kraft black liquor to avoid the formation of malodorous gases (Column 1, lines 54-61). The pollutants, the formation of which is to be avoided, include malodorous mercaptans, organic sulfides and polysulfides formed during the combustion, as well as other organic products which pollute the atmosphere (Column 1, lines 12-15). The process conditions are selected such that the components of the resultant gas are completely broken down to a stable fuel which consists of molecular hydrogen (at least 50% by volume), methane (2-3%), carbon monoxide (20%) and carbon dioxide (20-30%) (Column 2, lines 10-25). The product gas may also contain hydrogen sulfide which is readily removed from the gaseous fuel by scrubbing with alkali (Column 2, lines 26-38). It is important that the organic material be completely pyrolyzed and destructively distilled at a sufficiently high temperature and for sufficient length of time

to prevent recombination reactions and to produce stable end products (Column 2, lines 39-43). This purpose would not be achieved if gases were recovered from the process while the process is not finished. It would not be adequate to maintain the temperature in the first step of the process and ignore the second step.

In the present invention, the first step (pyrolysis) is carried out under conditions where the sulphur and sodium contents of the black liquor will mainly remain in the coke (page 5, lines 25-27 of the application as filed). The pyrolysis products may be gases, such as carbon monoxide, hydrocarbons and water, or pyrolysis oils or both (Page 7, lines 5-7). The optimum temperature for pyrolysis is between 550 and 650°C. The pyrolysis products may be used as a fuel at the mill or they may be processed further, e.g., into methanol, ethanol, etc. (page 8, lines 10-11). The gases produced in the gasification contain H₂, CO, H₂O and CO₂ (page 6, lines 4-5), and they can be burned in a boiler, in a gas power engine, in a paper impingement dryer, in a lime kiln or in other applications of a similar type (page 8, lines 12-14). The multiple advantages of the claimed new process are discussed on page 8, lines 16-25.

There is no apparent reason for a person skilled in the art to combine the elements of Brink and Hess in the way the present invention does. It would have been against the teaching of Brink to produce malodorous gases by taking out gases from the process between the two zones, when the object of the process is to avoid production of malodorous gases and to produce clean stable fuel gas.

The Examiner asserts that the combination of Brink and Hess would contain two gas streams. However, Brink teaches that gases are only recovered at the end of the completed process. The present invention teaches that two separate processes are carried out and completed in two separate reactors, and that gases are recovered at the end of each process.

Reducing the Capacity of the Gasification Step

One advantage of the present invention is that the capacity of the second reactor (in the application, called the gasification reactor) can be reduced. This is due to the fact that a part of the organic material, that is, evaporable compounds and vaporized water, are recovered already from the first reactor (in the application, called the pyrolysis reactor) and not passed into the second reactor.

In the process according to Brink, all substance from the first zone is passed to the second zone and the pyrolysis products generated in the first zone are, at least partly, used as fuel in the second zone. This reduces the overall yield of stable gaseous fuel produced in the process.

Gasification of black liquor is a delicate process that demands a high temperature and controlled conditions. Due to the high temperature and the presence of alkali, the process is detrimental to the equipment in which it is conducted. Thus the equipment used in gasification, e.g., the second zone of Brink, is of a very expensive construction.

In the present invention, the more expensive second reactor may be constructed to be much smaller in size than in the process taught by Brink. The inventors have estimated that it would be possible to reduce the percentage of organic matter conducted to the second reactor to 10-20% of the organic dry matter of the black liquor by recovering 80-90% of the organic matter in the form of product gas from the first reactor. Another advantage is that the water content of the black liquor need not be heated to the higher temperature of the second reactor.

Comparison of the Three Processes

Brink teaches a two-zone process of destructive distillation and pyrolysis, producing stable gaseous fuel, which also contains vaporized water, and smelt that contains inorganic chemicals.

The process of Hess only comprises one step, which is carried out under sufficient pressure to prevent vaporization of water. The process produces a large amount of coke, a small amount of gas, and an aqueous liquid containing inorganic chemicals.

The process according to the present invention comprises two separate steps. The first step includes pyrolysing the black liquor in the absence of an external gas component under such conditions that water is allowed to vaporize and evaporable compounds of the black liquor are converted to gaseous phase. After this first step, gases A and water vapor are recovered, and coke, which also contains inorganic chemicals, is passed to a second step, which is carried out at a higher temperature. The second process step produces product gas B and smelt that contains inorganic chemicals. The product gases A recovered from the first reactor and the product gases B recovered from the second reactor are different in their quality and they have a different potential for use.

Brink

Brink discloses a process for producing a stable gaseous fuel by the combustion of organic material while preventing the formation of atmospheric pollutants. The process comprises effecting destructive distillation and pyrolysis of the material in an enclosed zone. The process is initiated in a first enclosed pyrolysis zone at a temperature below a cracking temperature at which recombination reactions of intermediate products are prevented but which is effective to vaporize water and other liquids present and to initiate pyrolysis of the organic material. Hot effluent (vaporized water and dried solids) from the first zone is passed into a second enclosed pyrolysis zone wherein said cracking temperature is maintained to prevent said recombination reactions and to form a stable gaseous fuel.

The process of Brink is carried out in two enclosed zones at two different temperatures. The first zone may be considered as a preheating and flash-drying zone, preceding the second zone and converting the black liquor to a state in which it is easier to handle in the second zone. Brink does not teach two separate processes carried out one

after another but instead teaches one process that is carried out in two connected zones. No substance is intended to be taken out from the enclosed process vessel while the process is still in progress.

Brink teaches that stable gaseous fuel can only be produced in an enclosed zone that comprises a first zone at a first temperature and a second zone at a second temperature. To prevent formation of pollutants, it is important to keep the temperature in the second zone at an elevated cracking temperature. Brink does not teach that stable gaseous fuel could be produced in the first zone that is only intended for pretreatment and preheating of the black liquor before entering the second zone.

The objective of Brink is to convert the organic matter of black liquor into a stable gaseous fuel. Accordingly, the purpose of Brink is not to produce coke from black liquor. Actually, Brink does not even mention that there would be coke produced in the process. It only says that in the first enclosed zone, the black liquor is flash dried to dry solids (Column 3, lines 5-8; Column 4, lines 1-2; and Column 5, lines 24-26).

Hess

Hess discloses a process for coking of black liquor in the absence of added free oxygen. The process is carried out at a temperature in the range of about 232° to about 371°C under sufficient pressure to prevent vaporization of water. The end products comprise coke, gas and an aqueous effluent containing inorganic salts.

The primary objective of Hess is to produce a maximum amount of coke from black liquor and gas is just an unavoidable byproduct. Coke produced in the process may be burned to supply heat for the process and to recover chemicals contained therein, used as a soil conditioner, further carbonized by heating to produce high grade coke for metallurgical purposes, or heated and partially oxidized to produce a good grade of activated carbon (Column 3, lines 27-33). None of these applications comprise production of gaseous fuel.

There is no apparent reason why a skilled person would have combined the teachings of Brink and Hess because the two processes are so different and their objectives are different.

Conclusion

For the above reasons, Applicants believe that a person skilled in the art would not have considered combining the teaching of Brink with the teaching of Hess. Neither Brink nor Hess gives any hint that would have motivated a skilled person to modify the process of Brink in a way that would result in a process defined in the claims of the present application. Production of dimethyl sulfide would not have been a good motive for combining and modifying the two processes.

One of many advantages of the present invention is that the capacity of the second reactor can be reduced when only a reduced portion of the organic matter of black liquor is conducted to the second reactor. Neither Brink nor Hess addresses the problem of reducing the costs of the second process step following the initial pyrolysis step.

VII. CLAIMS APPENDIX (37 C.F.R. §41.37(c)(1)(viii))

1. Method for treatment of black liquor at a pulp mill in order to recover its contents of chemicals and energy, comprising the following steps:

passing a black liquor flow (10) from an evaporation plant to a pyrolysis reactor (1),

pyrolysing the black liquor in the pyrolysis reactor at a temperature of 300-800°C in the absence of an external gas component in order to separate evaporable compounds (12) from coke (11) remaining in a solid state,

recovering the evaporable compounds (12) from the pyrolysis reactor, passing the coke (11) from the pyrolysis reactor to a gasification reactor (3) for gasification,

gasifying the coke in the gasification reactor under such conditions that sulphur compounds contained in the coke (11) and deriving from the cooking chemicals are reduced to sodium sulphide, and

recovering product gases generated by gasification in the gasification reactor.

2. Method according to claim 1, wherein only a part of the black liquor flow (10) arriving from the evaporation plant is taken to the pyrolysis reactor (1), whereas a second part of the black liquor flow (10) is taken to a soda recovery boiler (3) where it is burnt in order to recover its contents of chemicals and energy.

3. Method according to claim 1, wherein the evaporable compounds (12) separated from the black liquor in the pyrolysis reactor (1) are used at the mill as fuel in part or entirely.

4. Method according to claim 1, wherein the evaporable compounds (12) separated from the black liquor in the pyrolysis reactor (1) are processed further.

5. Method according to claim 1, wherein product gases (14) resulting from the gasification are used at the mill as fuel in part or entirely.

6. (Cancelled)

7. Method according to claim 1, wherein the pyrolysis reactor (1) is for a batch process, whereby increasing of the temperature may begin from the temperature of the black liquor arriving in the reactor, while the final temperature is chosen according to the desired final products.

8. Method according to claim 1, wherein the pyrolysis reactor (1) is for a continuous process.

9. Method according to claim 1, wherein the pyrolysis is carried out in such process conditions (temperature, pressure, residence time, heating speed, etc.), wherein the evaporable compounds (12) mainly consist of non-condensing gases.

10. Method according to claim 1, wherein the pyrolysis is carried out in such process conditions (temperature, pressure, residence time, heating speed, etc.), wherein the evaporable compounds (12) mainly consist of pyrolysis oil.

VIII. EVIDENCE APPENDIX (37 C.F.R. §41.37(c)(1)(ix))

Attached is a schematic diagram illustrating the principal differences of the processes of Brink, Hess and the present invention.

IX. RELATED PROCEEDINGS APPENDIX (37 C.F.R. §41.37(c)(1)(x))

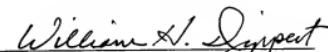
There are no related proceedings.

X. SIGNATURE PAGE

Reconsideration and allowance of all the claims herein are respectfully requested. In the event that any extensions and/or fees are required for the entry of this Appeal Brief, the Patent and Trademark Office is specifically authorized to charge such fee to Deposit Account No. 23-2820 in the name of Wolf Block LLP.

Respectfully submitted,

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